

iv. Warm Space Components Allocations

In this section, the space allocations of "day-one" ring devices and components in the warm sections are defined. The reserved locations of components to be added later on, but impacting the "day-one" design, are also marked in parentheses. The data given here is being used in the preparation of the AUTOCAD Master Ring Drawings. The drawings together with the Optics Database represent the source for the Survey Database and, consequently, define the installed location of the warm space components.

The magnet positions in both RHIC rings are fixed and defined by the Optics Database. The Optics Database includes, in addition to magnets, all components which affect the beam or perform beam diagnostics, in particular rf cavities, BPMs, wall current monitors, gate valves, etc. These elements are defined in "slots" which are delimited between two connecting flanges at the ends. Correspondingly, a warm space is defined as drift space between the magnet elements, with the warm space being measured as the distance between the conflat flanges at the ends of the cold cryostats. AUTOCAD coordinates of the magnet centers and component positions are provided directly from the Optics Database in "dxf" format, readable by AUTOCAD. In the AUTOCAD Drawings for the warm spaces, the component locations are defined by the clockwise distance from the nearby Interaction Point (IP), as measured on the "equivalent" orbit. In order to keep track of the location of these components with respect to the Optics Database, a special table called "pointLoc" (for point location) is maintained in the database server. PointLoc records the name of a component and its azimuthal distance from its slot ends, which are defined in the Optics Database. Thus the position of a component with respect to the nearby IP can be reconstructed and pointLoc will be used to generate reports for direct comparison with the Master Ring Drawings.

The layout of the components in the six interaction regions (IR) is illustrated in the Figs. 0.8 - 0.13. All warm spaces, other than those around the IPs, are jumpered by cryogenic by-passes within the tunnel and which start and end with cold-to-warm transitions. The warm space length is defined between the conflat flanges of the transitions. The warm spaces are terminated by bakeable beam vacuum gate valves directly attached to the flanges at all cryostat ends of Q4, Q3, Triplet and DX (except DX on the triplet side). Warm bakeable devices and vacuum pipes are interconnected between the valves, usually by bellows. The space allocation for warm devices and the interconnecting beam tubes and bellows is detailed in the AUTOCAD Drawings. The warm spaces are classified as *long* and *short* warm drift spaces as follows:

Long Warm Drift Spaces at each of the six interaction regions (IRs).

1. From the IP up to DX magnets on each side. This warm space is to $l = 7.120$ m in every IR, and is defined as the distance from the crossing point up to the flange on the bellows of the ion pump stand connected to the warm beam position monitor at the DX cryostat. (The distance from the IP to the DX flange is 8.614 m).
2. From the end of the cryostat at the Q3 magnet to the beginning of either a Q4 magnet or a *spin rotator*. The length of the warm space from the triplet cryostat flange (38.439 m from the IP) to the flange of the Q4 quadrupole is $l = 34.122$ m. On both sides of the 6 and 8 o'clock interaction points, cold spin rotators are connected to the quadrupole Q4, reducing the warm space to $l = 21.660$ m in the 6 and 8 o'clock IRs. Until the spin rotators are built, *dummy* cryostats with the same dimension are installed.

Short Warm Drift Spaces between the D0 and DX magnet in every IR.

The DX-D0 warm space of $l = 4.895$ is identical at every IR, and represents the distance between the flanges at the end of the DX cryostat and at the vacuum valve connected to the D0 cryostat. In the *yellow* ring at 5 o'clock and the *blue* ring at 6 o'clock, there are two *additional* short warm spaces for the injection magnetic septum (Lambertson) magnets at Q7-Q8 and the fast injection kicker magnets at Q9 - D9.

Fig. 0-8. Warm space devices around IP2.

Fig. 0-9. Warm space devices around IP4.

Fig. 0-10. Warm space devices around IP6.

Fig. 0-11. Warm space devices around IP8.

Fig. 0-12. Warm space devices around IP 10.

Fig. 0-13. Warm space devices around IP12.